Sensitivity analysis of climate change risk assessment
Study of parameters variation in hazard indicators

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Supervisors
Prof.ssa Elisa Palazzi
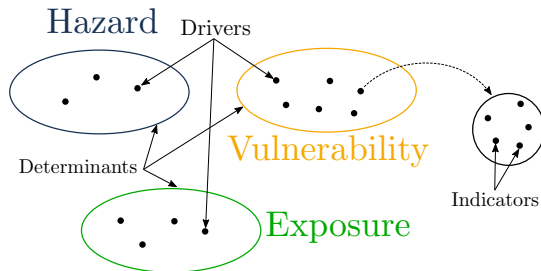Prof. Alberto Viglione

University of Turin

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Introduction

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- Climate Change Risk Assessment (CCRA)

The problem

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- ▶ The choice of indicators is arbitrary
- ▶ Analysis of the sensitivity of indicators to a change in value of their parameters, for drivers within the hazard determinant

Case study

- ▶ Torino Airport

Case study

- ▶ Torino Airport
- ▶ Hazard drivers: heat wave, heavy precipitation

Climate datasets

- Climatological baseline: ERA5[1]
- Climate projections: NEX-GDDP-CMIP6[2]

[2]Hersbach et al., *ERA5 Hourly Data on Single Levels from 1940 to Present*.

[2]Thrasher, Wang, Michaelis, and Nemani, *NEX-GDDP-CMIP6*; Thrasher, Wang, Michaelis, Melton, et al., "NASA Global Daily Downscaled Projections, CMIP6".

ERA5

- ▶ Organisation: European Centre for Medium-Range Weather Forecasts
- ▶ Data type: reanalysis
- ▶ Spatial coverage: global
- ▶ Spatial resolution: 0.25° x 0.25°
- ▶ Temporal coverage: 1940-present
- ▶ Temporal resolution: hour

NEX-GDDP-CMIP6

- Organisation: NASA Earth Exchange
- Data type: statistically downscaled bias-corrected climate projections
- Spatial coverage: global
- Spatial resolution: 0.25° x 0.25°
- Temporal coverage: 1950-2100
- Temporal resolution: day
- Historical period 1950-2014, projection period 2015-2100
- Model: EC-Earth3
- Scenario: SSP1-2.6, SSP2-4.5, SSP5-8.5

Spatial domain

- Box of 3 x 3 grid points centred at the coordinates of the airport

Temporal domain

- Baseline period: 1994–2023
- Time horizons: 2021-2040, 2051-2070, 2081-2100

- ▶ Indicators: heat wave frequency, maximum n-days precipitation
- ▶ Fixed exposure and vulnerability from literature

Methodology

- Indicators: heat wave frequency, maximum n-days precipitation
- Fixed exposure and vulnerability from literature
- Evaluate risk following the guidelines

Preprocessing

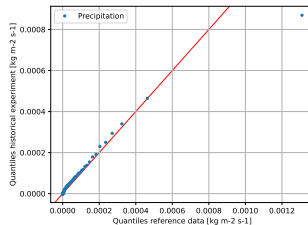1. Regrid ERA5
2. Aggregate ERA5 at daily frequency
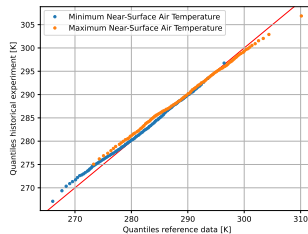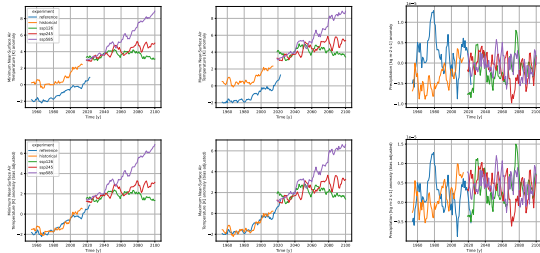3. Align NEX-GDDP-CMIP6 timestamps

Preprocessing

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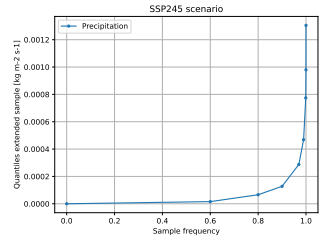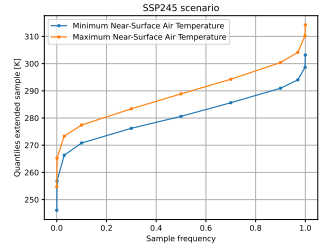4. Bias adjustment
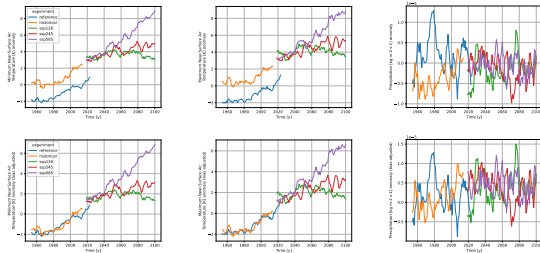
Preprocessing

1. Regrid ERA5
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3. Align NEX-GDDP-CMIP6 timestamps
4. Bias adjustment

Evaluation of hazard indicators

1. Define intervals of parameter values

Evaluation of hazard indicators

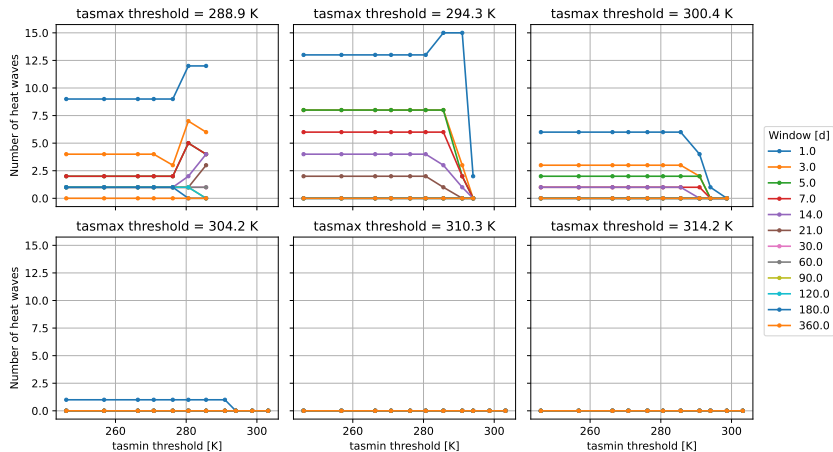1. Define intervals of parameter values
2. Spatial aggregation

Evaluation of hazard indicators

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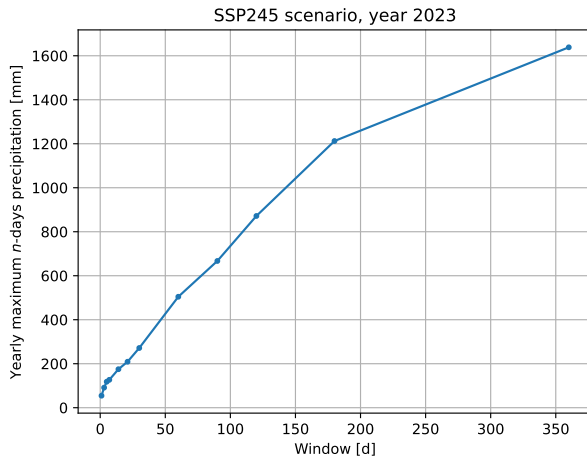2. Spatial aggregation
3. Temporal aggregation

Evaluation of hazard indicators

1. Define intervals of parameter values
2. Spatial aggregation
3. Temporal aggregation
4. Risk evaluation

Heat wave frequency

Maximum *n*-days precipitation

Next steps

- ▶ Extend analysis to other indicators for same hazard drivers
- ▶ Extend analysis to Bologna's and Ciampino's airports
- ▶ Sample intervals specifically for the location of interest
- ▶ Evaluate uncertainty
- ▶ Evaluate risk with non-linear relations among hazard indicators and among determinants